



To : _____

Specification of FUJITSU TFT-LCD module

NA19026-C661

Approval
Date : By :

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Specification No. : Tech Bes LCD-00288

Issue Date : September 8, 2004

Issued by :

K. Tanaka
Project Director
LCD Product Div.

FUJITSU DISPLAY TECHNOLOGIES CORPORATION

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1. APPLICATION

This specification applies to the 15-inch XGA TFT-LCD module.

2. PRODUCT NAME AND MODEL NUMBER

2.1.Product Name 15-inch XGA TFT-LCD Module

2.2.Model Number NA19026-C661

3. OVERVIEW

This LCD Module is a display unit that uses a liquid crystal panel with a TFT active matrix method with a display capacity of 1024x3(RGB)x768 dot and screen size of 38cm (15.0 inch). This LCD module corresponds to the LVDS 1ch interface and can display 260 thousand colors. In addition, this LCD module operates under a non-interlace mode. It has a backlight of CCFL that is built in and supplies more electric power than the exclusive inverter places externally. The power supply of this LCD module is +3.3V DC voltage.

4. CONFIGURATION

This LCD module consists of a color TFT LCD panel and a bezel where the panel driver IC is mounted into the printed substrate, a cold-cathode florescent tube backlight, and a LVDS interface PBC. These are all combined into one structure.

The inverter that supplies electric power to the backlight is configured separately from the LCD module.

Figure 4-1 shows a block diagram of this LCD module.

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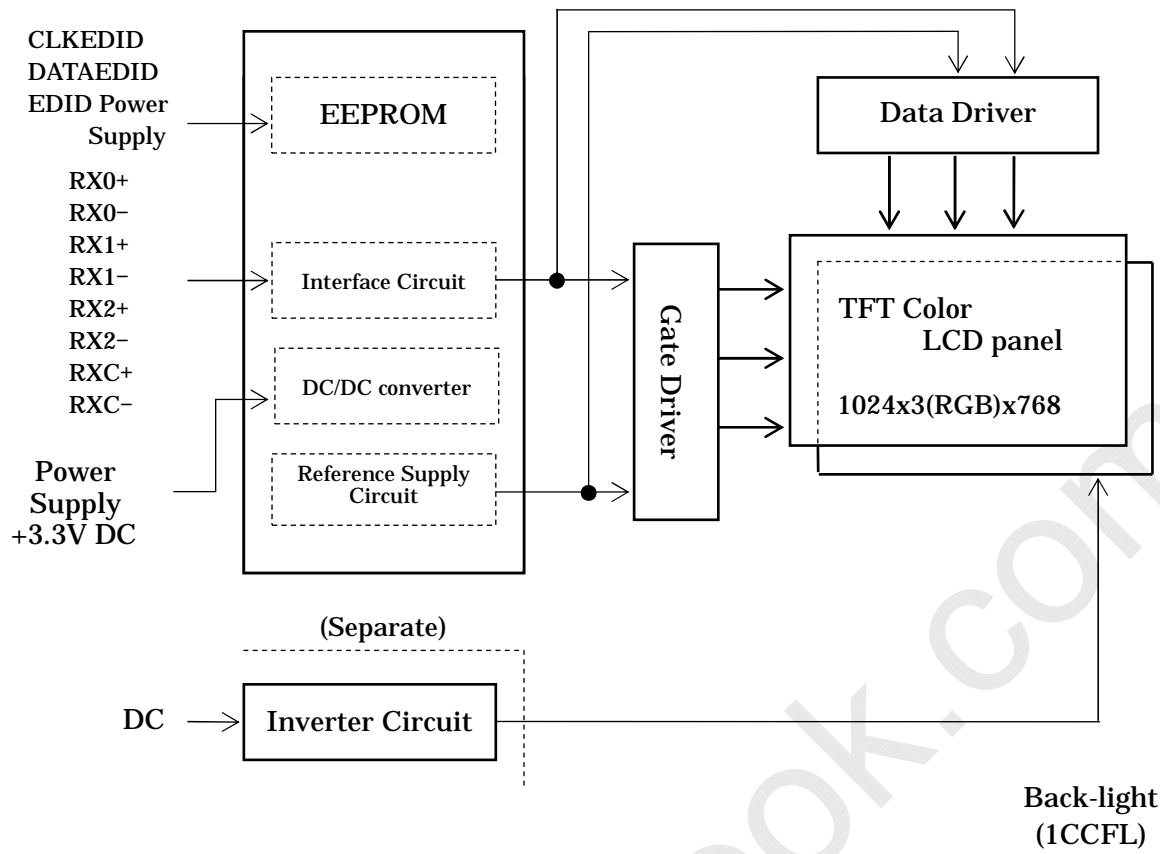


Figure 4-1 Block Diagram

5.MECHANICAL SPECIFICATIONS

Table 5-1 shows the mechanical specifications of this LCD module.

Table 5-1 Mechanical Specifications

Item	Specifications	Unit	Remark
Dimensions	317.3×241.8×7.0 (max)	mm	Edge type back-light is used Inverter excluded For details on dimension, see dimensional outline drawing (on page 35,36)
Display Resolution	(1024×3)×768	—	
Display Dot Area (Drive range)	304.128×228.096	mm	
Dot Pitch	0.297×0.297	mm	
Pixel Aspect Ratio	1 : 1	—	
Weight	670 max	g	

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6. ABSOLUTE MAXIMUM RATING

Table 6-1 shows the absolute maximum rating of this LCD module.

Table 6-1 Absolute Maximum Rating

Item	Symbol	Condition	MIN.	TYP.	MAX.	UNIT
Supply Voltage (3.3V)	V _{CC}	Ta=25℃	-0.3	—	4.0	V
Supply Voltage (EDID)	V _{EDID}		-0.3	—	6.25	V
Input Signal Voltage (LVDS)	V _{IN}		-0.3	—	V _{cc} +0.3	V
Input Signal Voltage (EDID)	V _{INED}		-0.3		V _{EDID} +0.3	V

7. RECOMMENDED OPERATIONG CONDITIONS

Table 7-1 shows the recommended operating conditions

Table 7-1 Recommended Operating Conditions

Item	Symbol	MIN.	TYP.	MAX.	UNIT
Supply Voltage (3.3V)	V _{CC}	3.0	3.3	3.6	V
Supply Voltage (EDID)	V _{EDID}	2.7	—	5.5	V
Ripple Voltage (V _{CC})	V _{RP}	—	—	100	mVp-p

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8. ELECTRICAL SPECIFICATIONS

Table 8-1 shows the electrical specifications of this LCD module. Figure 8-1 shows the measurement circuit. Figure 8-2 shows the equivalent circuit of the logic signal input area.

Table 8-1 Electrical Specifications

Item		Symbol	Condition	MIN.	TYP.	MAX.	Unit
Differential input Voltage (+)		V _{IH}	V _{cm} =+1.2V	—	—	100	mV
Differential input Voltage (—)		V _{IL}		-100	—	—	mV
Supply Current		I _{CC}	V _{CC} =+3.3V V _{SS} =0V	—	560	850	mA
Supply Rush Current		I _{SCC}	T _a =25°C CK=54.0MHz	—	—	2.5	A
Supply Rush Current Duration (excess 1.2A)		T _{SCC}	Frame frequency =60Hz	—	—	2	ms
BACK LIGHT	CCFL Turn on Voltage (Note)	V _S	f _L =50kHz,T _a =25°C, C _L =22pF	—	—	1650	Vrms
			f _L =50kHz,T _a =0°C, C _L =22pF	—	—	1700	Vrms
	Lighting Voltage	V _L	f _L =50kHz,I _L =6mA	—	730	—	Vrms
	Lighting Frequency	f _L	V _L =730Vrms,I _L =6mA	40	60	80	kHz
	Recommended Lighting Frequency			50	—	60	kHz
	FL tube Current (Note2)	I _L	V _L =730Vrms f _L =50kHz	2	6	6.5	mA

Note) The CCFL turn on voltage is set under the appointed criteria and shall exceed the maximum range of the specification.

●Measurement circuit is based on Figure 8-1

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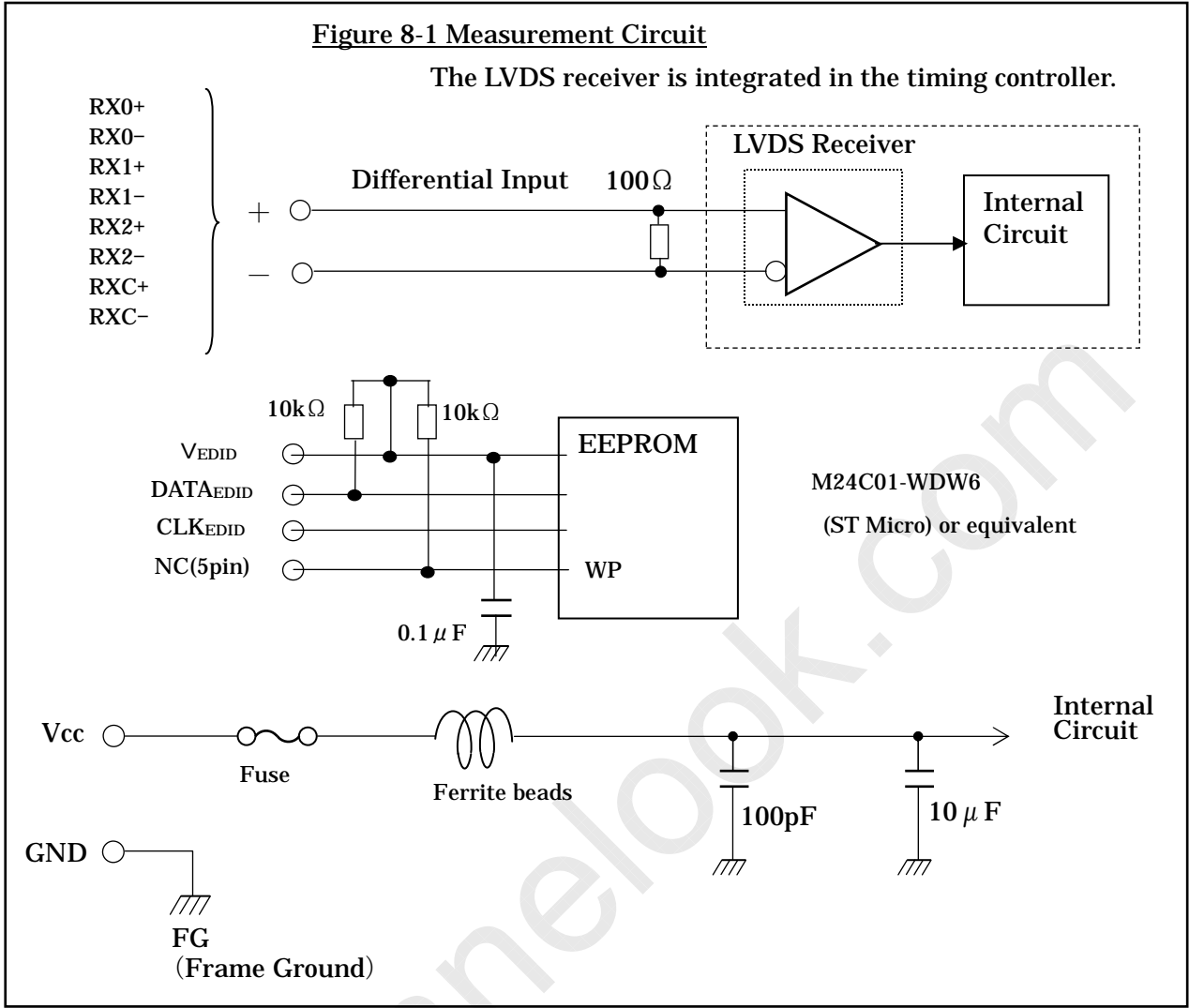


Figure 8-2 Equivalent circuit of logic signal input

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9.. OPTICAL SPECIFICATIONS

Table 9-1 shows the optical specifications of this LCD module.

Table 9-1 Optical Specifications

Item	Symbol	Condition		Specification			Unit	Remark	Note
				MIN.	TYP.	MAX.			
Visual Angle	$\theta_{L,R}$	$CR \geq 10$ $Ta=25^{\circ}C$	$\theta_{U,D=0^{\circ}}$	80	—	—	deg	Top Bottom	(1)(2) (3)(5) (6)
	$\theta_{U,D}$		$\theta_{L,R=0^{\circ}}$	80	—	—	deg	Left Right	
Contrast Ratio	CR	$\theta_{L,R,U,D}=0^{\circ}$ $Ta=25^{\circ}C$		250	400	—	—	White / Black*1	(1)(3) (5)
Response Time (ON) (B→W)	t_{ON}	$\theta_H=0^{\circ}$ $\theta_V=0^{\circ}$	$Ta=25^{\circ}C$	—	15	30	ms		(1)(4) (5)
			$Ta=0^{\circ}C$	—	50	100	ms		
Response time (OFF) (W→B)	t_{OFF}	$\theta_H=0^{\circ}$ $\theta_V=0^{\circ}$	$Ta=25^{\circ}C$	—	10	25	ms		
			$Ta=0^{\circ}C$	—	50	100	ms		
Brightness	L	$\theta_H=0^{\circ}$ $\theta_V=0^{\circ}$ $Ta=25^{\circ}C$ $fL=50kHz$ $If=6mA$		190	300	—	cd/m ²	All white display *2,3,4	(1)(5)
Brightness Uniformity	ΔL			60	—	—	%		(1)(7)
Chromaticity (White)	x			0.283	0.313	0.343	—		(1)(5)
	y			0.299	0.329	0.359	—		
Color Purity (NTSC ratio)						55	63	—	%
LCD Panel Type				TFT Color					
Display Mode				Normally Black					
Wide Viewing Angle Technology				MVA					
Optimum Viewing Angle				Symmetry					
Display Color				262,144 (6 bit color)					
Color of non-display area				Black					
Surface Treatment				Glare Low reflection 2H					

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Note

- *1) Brightness, Chromaticity, Contrast is measured at a spot diameter of $\varnothing 2$ and a distance=500mm.
- *2) The value is measured 15-20 minutes after the light on.
- *3) The power supply condition is VCC=3.3V,fL=50kHz,If=6mA when the optical specification is measured.
- *4) The operation life of the CCFL is limited. The brightness will deteriorate over time.

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Note 6) Definition of Optimum Viewing Angle

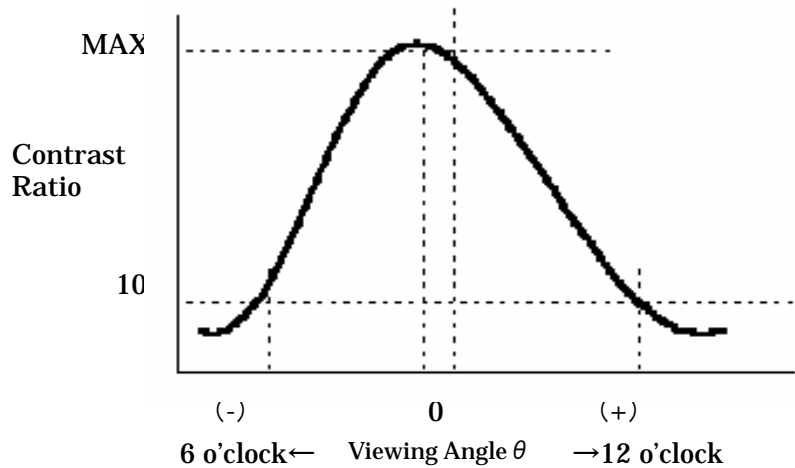
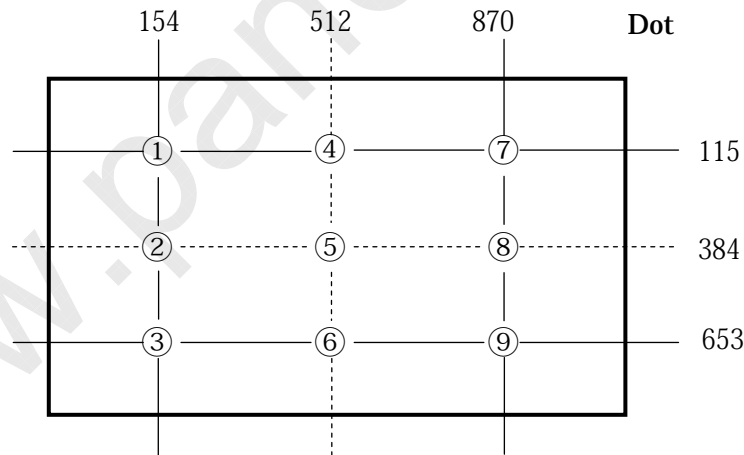


Figure 9-6 Definition of Viewing Angle

Note 7) Definition of Brightness Uniformity

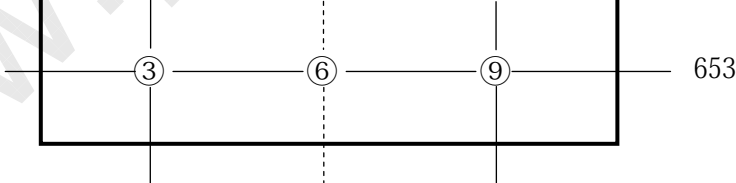
The Brightness Uniformity is defined by the following formula using 9 points (①~⑨) of the brightness measuring value shown bellow.

Definitional Equation:
$$\{ (\text{Minimum Brightness of ①~⑨}) / (\text{Maximum Brightness of ①~⑨}) \} \times 100 [\%]$$



Note) The center of each position is defined by the center spot position of the brightness meter in which the tolerance of the measurement position is $\pm 3\text{mm}$.

Figure 9-7 Measuring Points

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	<p>Note) The center of each position is defined by the center spot position of the brightness meter in which the tolerance of the measurement position is $\pm 3\text{mm}$.</p>									
	<p><u>Figure 9-7 Measuring Points</u></p>									
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10. INTERFACE SPECIFICATIONS

10.1 Interface Signal Alignment

Table 10-1 shows the description and configuration of the interface signals (CN1)

Table 10-1 Interface signals

Pin No.	Symbol	Function
1	VCC	+3.3V power supply
2	VCC	+3.3V power supply
3	VSS	Ground
4	VSS	Ground
5	RX0-	LVDS signal 0-
6	RX0+	LVDS signal 0+
7	VSS	Ground
8	RX1-	LVDS signal 1-
9	RX1+	LVDS signal 1+
10	VSS	Ground
11	RX2-	LVDS signal 2-
12	RX2+	LVDS signal 2+
13	VSS	Ground
14	RXC-	LVDS signal CLK-
15	RXC+	LVDS signal CLK+
16	VSS	Ground
17	V _{EDID}	DDC +3.3Vpower supply
18	NC	NC
19	CLK _{EDID}	DDC clock
20	DATA _{EDID}	DDC data

Connector used : FI-SEB20P-HF13
Adapted Connector : FI-SE20M
Name of Maker : Japan Aviation Electronics Ltd.

Note) Terminal 18 should be open.

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Table 10-2 LVDS Data Assignment

Input Signal *1	Transmitter DS90C365		Interface connector			LCD Control input
	pin	INPUT	System side	LCD module		
				pin		
R0 R1 R2 R3 R4 R5 G0	44 45 47 48 1 3 4	TxIN0 TxIN1 TxIN2 TxIN3 TxIN4 TxIN5 TxIN6	Tx OUT0+ Tx OUT0-	6 5	Rx0+ Rx0-	R0 R1 R2 R3 R4 R5 G0
G1 G2 G3 G4 G5 B0 B1	6 7 9 10 12 13 15	TxIN7 TxIN8 TxIN9 TxIN10 TxIN11 TxIN12 TxIN13	Tx OUT1+ Tx OUT1-	9 8	Rx1+ Rx1-	G1 G2 G3 G4 G5 B0 B1
B2 B3 B4 B5 RSVD RSVD ENAB	16 18 19 20 22 23 25	TxIN14 TxIN15 TxIN16 TxIN17 TxIN18 TxIN19 TxIN20	Tx OUT2+ Tx OUT2-	12 11	Rx2+ Rx2-	B2 B3 B4 B5 Not use Not use ENAB
DCLK	26	TxCLK IN	TxCLK OUT+ TxCLK OUT-	15 14	RxC+ RxC-	DCLK

*1 The RSVD (reserved) pin on the transmitter should be connected to the Ground

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Table 10-3 shows the correspondence between input signal and color

Color and Brightness Gradation			Data Signal (0:Low Level, 1:High Level)																							
			R5 R4 R3 R2 R1 R0						G5 G4 G3 G2 G1 G0						B5 B4 B3 B2 B1 B0											
Basic Color	Black		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Blue		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Green		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Cyan		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	Magenta		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	Yellow		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	White		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Red Gradation	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	↑	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Darker	2	0	0	0	0	1	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
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	Brighter	61	1	1	1	1	0	1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
↓	62	1	1	1	1	1	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Red	63	1	1	1	1	1	1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Green Gradation	Black	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	↑	1	0	0	0	0	0	0		0	0	0	0	0	0	1		0	0	0	0	0	0	0	0	
	Darker	2	0	0	0	0	0	0		0	0	0	0	1	0		0	0	0	0	0	0	0	0	0	
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	Brighter	61	0	0	0	0	0	0		1	1	1	1	0	1		0	0	0	0	0	0	0	0	0	
↓	62	0	0	0	0	0	0		1	1	1	1	1	0		0	0	0	0	0	0	0	0	0		
Green	63	0	0	0	0	0	0		1	1	1	1	1	1		0	0	0	0	0	0	0	0	0		
Blue Gradation	Black	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	↑	1	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	1			
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↓	62	0	0	0	0	0	0		0	0	0	0	0	0	0		1	1	1	1	1	0				
Blue	63	0	0	0	0	0	0		0	0	0	0	0	0	0		1	1	1	1	1	1				

Note 1) Definition of gray scale: Color (n)..."n" indicates the gray scale level.

The larger number means brighter level.

Note 2) Data: 1:High level, 0:Low level

Note 3) There are 18 color data which consists of 6 bit of red, green and blue where they individually display 64 signals. By combining these colors, 262,144 colors can be displayed.

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10.3 INPUT SIGNAL TIMING

The input signal timing is shown in table 10-3 and figure 10-1.

Table 10-3 Timing Characteristics (Ta=0~50℃, Vcc=3.3±0.3 V)

Item		Symbol	MIN.	TYP.	MAX.	Unit	Remark
DCLK Signal (Clock)	Period	Tc	15.15	15.38	16.67	ns	*4
	Frequency	1/Tc	60	65	66	MHz	
	Duty	Tch/Tc	45	50	55	%	
	High time	TclkH	6.0	—	—	ns	
	Low time	TclkL	6.0	—	—	ns	
DCLK-Data Timing	Setup time	Tset	3	—	—	ns	
	Hold time	Thold	5	—	—	ns	
Horizontal Signal	Horizontal period	Th	1320	1344	2046	DCL K	*1,4
	Hor. Period (1)	Th	18.0	20.68	—	μs	*4
	Hor. Display period	Thd	1024	1024	1024	DCL K	*2
Vertical Signal	Vertical Period	Tv	780	806	1023	Th	*1
	Ver. Frequency	1/Tv	55	60	65	Hz	16.67ms
	Ver. Display period	Tvd	768	768	768	Th	*2
ENAB signal	Data ENAB timing	Tdn	—	0	—	DCL K	*3

- *1) • The horizontal direction of the display position is defined by the rise of the ENAB signal. Right after the signal rises, the latched data is displayed from the left edge of the screen. The vertical direction of the display position is when the ENAB signal changes from “H” to “L” and “L” is over 2048 DCLK, then the next risen ENAB signal data is displayed from the top line of the screen.
- *2) • If the “H” period of the ENAB signal is less then 1024 DCLK, then black is displayed on the remaining area.
• If the ENAB signal is less than 768 Th within a frame, then the displayed data is continuously displayed from the top line of the screen continuously.
- *3) • If the valid data period and the “H” period of the ENAB signal do not synchronize, then the display position is displayed as out of place.
- *4) When the horizontal period is less than 1320 DCLK or 18 μs, the display quality such as unevenness and light line defect can occur.
If the DCLK frequency exceeds 66MHz, garbled data may cause flickering.
In addition, if the DCLK frequency is less than 60MHz, then unevenness may occur.

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10.4 Correspondence between Data and Display Position

Figure 10-2 shows the Correspondence between Data and Display Position.

S0001 S0002 S0003 S0004 S0005 S0006 S0007 S0008 ----- S3071 S3072											
C001	R 0001	G 0001	B 0001	R 0002	G 0002	B 0002	R 0003	G 0003		G 1024	B 1024
C768	R 0001	G 0001	B 0001	R 0002	G 0002	B 0002	R 0003	G 0003		G 1024	B 1024

Figure 10-2 Correspondence Data and Display Position

10.5 Power Supply Sequence

Figure 10-3 defines the rise time of the power supply, voltage descent and the power supply sequence. Especially the sequence of power supply and the input signal is necessary to latch up of the driver IC and DC driving.

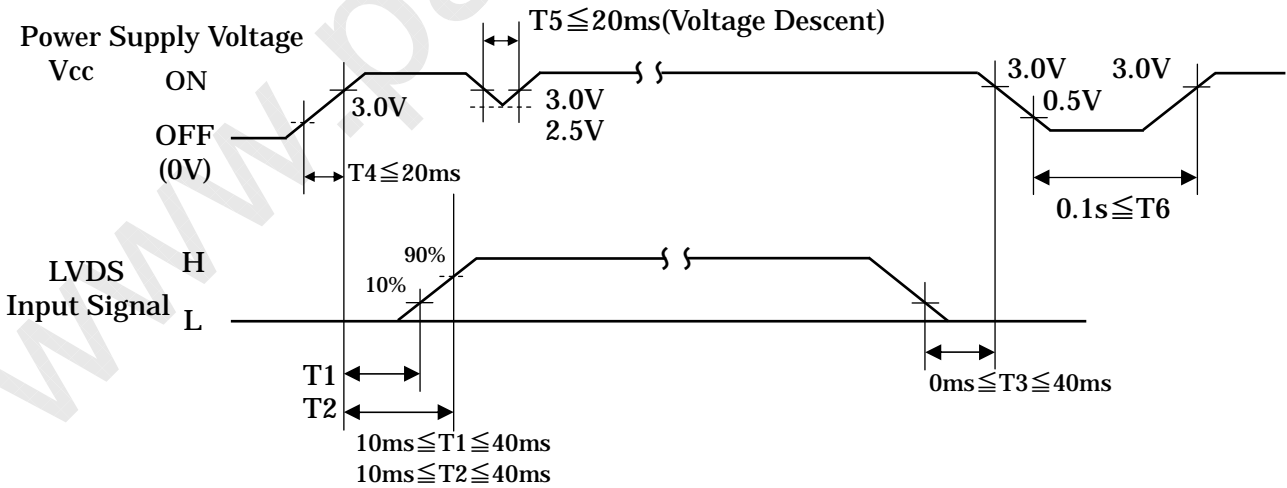


Figure 10-3 Power Supply Sequence

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10.6 EDID Signal Timing

Table 10-4 shows DC characteristics of EDID signals. Figure 10-4 shows input timing.
Table 10-5 shows AC characteristics and Table 10-6 shows the contents of EDID data.

Table 10-4 EDID DC Characteristics (Ta=0~50℃, Vcc=3.3±0.3V)

Item		Symbol	MIN.	MAX.	Unit	Remarks
SCL,SDA Terminal input voltage	High voltage	VIH	0.7V _{EDID}	—	V	
	Low voltage	VIL	—	0.3V _{EDID}	V	
Hysteresis voltage		VHYS	0.05V _{EDID}	—	V	
Output voltage		VOL1 VOL2	— —	0.4 0.6	V V	IOL=3mA, V _{EDID} =2.5V IOL=6mA, V _{EDID} =2.5V
Input leak current	All input-and-output pins WP pin	Tv 1/Tv	-10 -10	10 50	μ A μ A	VIN=0.1V to V _{EDID} ,WP=VSS WP= V _{EDID}
Output leak current		Tdn	-10	10	μ A	VOUT=0.1V to V _{EDID}
Terminal capacity (Input and output)		Cin,Cout	—	10	p F	VCC=5.0V Ta=25℃, Fclk=1MHz
Operating current		ICC Wr ICC Re	— —	3 1	m A m A	V _{EDID} =5.5V,SCL=400KHz V _{EDID} =5.5V,SCL=400KHz
Stillness current		ICCS	— —	30 100	μ A μ A	VCC=3.0V,SDA=SCL=VCC VCC=5.5V,SDA=SCL=VCC WP=VSS,A0,A1,A2=VSS

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Table 10-5 EDID AC Characteristics

Item	Symbol	Vcc=2.5V-5.5V Standard operation mode		Vcc=4.5V-5.5V High-speed operation mode		Unit	Remarks
		MIN.	MAX.	MIN.	MAX.		
Clock frequency	Fclk	—	100	—	400	kHz	
Clock high time	THIGH	4000	—	600	—	ns	
Clock low time	TLOW	4700	—	1300	—	ns	
SDA, SCL rising time	TR	—	1000	—	300	ns	
SDA, SCL falling time	TF	—	300	—	300	ns	
START hold time	THD:SDA	4000	—	600	—	ns	
START setup time	TSU:STA	4700	—	600	—	ns	
DATA input hold time	THD:DAT	0	—	0	—	ns	
DATA input setup time	STU:DAT	250	—	100	—	ns	
STOP setup time	TSU:STO	4700	—	600	—	ns	
Output decision time from a clock	TAA	100	3500	100	900	ns	
Bus free time	TBUF	4700	—	1300	—	ns	
Minimum VIH, VIL Rising time	TOF	—	250	20+0.1CB	250	ns	CB≤100pF
Spike oppression (SDA, SCL pins)	TSP	—	50	—	50	ns	
A write-in cycle time	TWR	—	10	—	10	ms	Byte and page mode
The number of times of data rewriting	—	1M	—	1M	—	cycle	25℃, Vcc=5.0V block mode

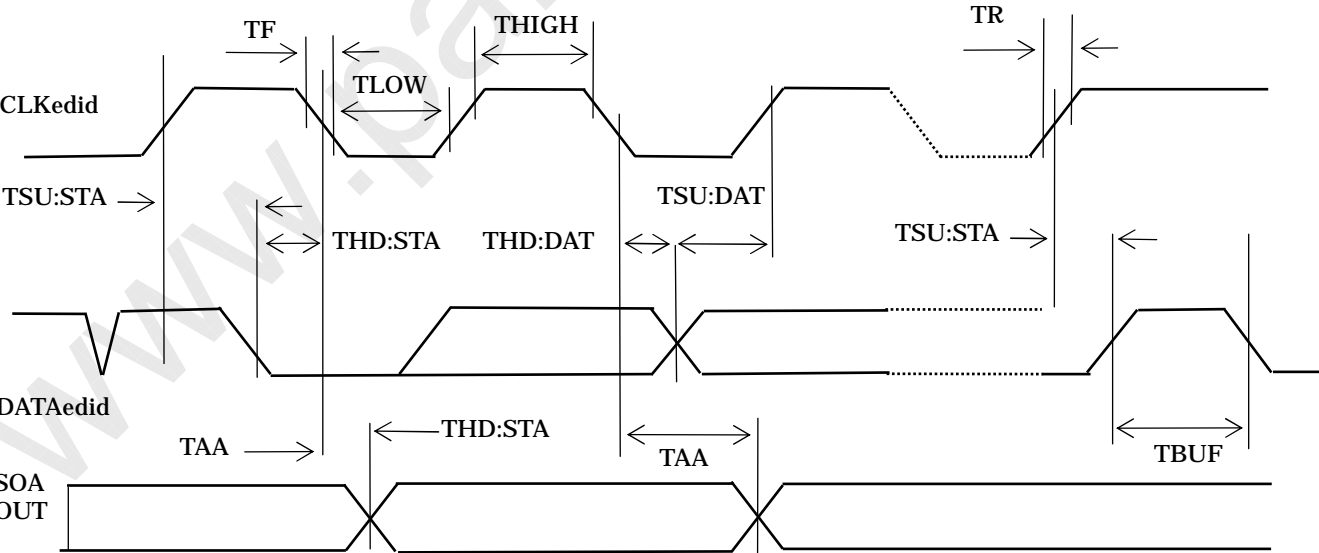


Figure 10-4 EDID signal timing

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Table 10-6 The Contents of EDID data

Add ress	No. Byte s	Description	Data	Addr ess	No. Byte s	Description	Data
Header (8bytes)				Color Characteristics (10bytes)			
00h	1		00h	19h	1	Red/Green Low Bits	**h
01h	1		FFh	1Ah	1	Blue/White Low Bits	**h
02h	1		FFh	1Bh	1	Red-x	**h
03h	1		FFh	1Ch	1	Red-y	**h
04h	1		FFh	1Dh	1	Green-x	**h
05h	1		FFh	1Eh	1	Green-y	**h
06h	1		FFh	1Fh	1	Blue-x	**h
07h	1		00h	20h	1	Blue-y	**h
Vendor/Product identification (10 bytes)				21h	1	White-x	**h
08h	2	ID Manufacturer name	1894h	22h	1	White-y	**h
0Ah	2	ID product code	****h	Established timing (3 bytes)			
0Ch	1	ID serial number	**h	23h	1	Established Timings1	00h
0Dh	1	ID serial number	**h	24h	1	Established Timings2	00h
0Eh	1	ID serial number	**h	25h	1	Manufactures reserved timing	00h
0Fh	1	ID serial number	**h	Standard timing identification (16 bytes)			
10h	1	Week of manufacture	**h	26h	2	Standard timing Identification #1	61h 40h
11h	1	Year of manufacture	**h	28h	2	Standard timing Identification #2	01h 01h
EDID (2bytes)				2Ah	2	Standard timing Identification #3	01h 01h
12h	1	Version #	01h	2Ch	2	Standard timing Identification #4	01h 01h
13h	1	Revision #	03h	2Eh	2	Standard timing Identification #5	01h 01h
Basic display parameter/features (5 bytes)				30h	2	Standard timing Identification #6	01h 01h
14h	1	Video input definition	80h	32h	2	Standard timing Identification #7	01h 01h
15h	1	Max. horizontal image size	1Eh	34h	2	Standard timing Identification #8	01h 01h
16h	1	Max. vertical image size	17h				
17h	1	Display transfer Characteristics (Gamma)	B4h				
18h	1	Feature support	08h				

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A	Detailed timing description (72 bytes)				Detailed timing description #3 or monitor Descriptor (18 bytes)			
	Detailed timing description 1 (18 bytes)							
B	36h			64h	56h			00h
	37h			19h	57h			00h
	38h			00h	58h			00h
	39h			40h	59h			00h
	3Ah			41h				
	3Bh			00h	5Ah			00h
	3Ch			25h	5Bh			00h
	3Dh			30h	5Ch			00h
	3Eh			00h	5Dh			10h
	3Fh			00h	5Eh			00h
C	40h			00h	5Fh			00h
	41h			00h	60h			00h
	42h			30h	61h			00h
	43h			E4h	62h			00h
	44h			10h	63h			00h
	45h			00h	64h			00h
	46h			00h	65h			00h
	47h			18h	66h			00h
	Detailed timing description #2 or monitor descriptor (18 bytes)				67h			00h
	48h			00h	68h			00h
D	49h			00h	69h			00h
	4Ah			00h	6Ah			00h
	4Bh			10h	6Bh			00h
	4Ch			00h	Detailed timing description #4 or monitor descriptor (18 bytes)			
	4Dh			00h	6Ch			00h
	4Eh			00h	6Dh			00h
	4Fh			00h	6Eh			00h
	50h			00h	6Fh			10h
	51h			00h	70h			00h
	52h			00h	71h			00h
E	53h			00h	72h			00h
	54h			00h	73h			00h
	55h			00h	74h			00h
					75h			00h
					76h			00h
F								

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A

B

C

D

E

F

Add ress	No. bytes	Description	Data
77h			00h
78h			00h
79h			00h
7Ah			00h
7Bh			00h
7Ch			00h
7Dh			00h
7Eh			00h
7Fh		Check Sum	**h

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11 BACK-LIGHT SPECIFICATION

11-1 Pin configuration for Back-light

Table 11-1 shows the description of the pin assignment and the types of back-light (CN-2)

Table11-1 Pin Assignment of CN-2

Pin No.	Signal	Function	Remark
1	V _H	Power supply for CCFL (High)	Cable color: Pink
2	V _L	Power supply for CCFL (Low)	Cable color: White

Used connector : B H S R - 0 2 V S - 1
Applied connector : S M 0 2 B - B H S S - 1
Maker : Japanese Solderless Terminal Trading Company LTD. (J.S.T)

11-2 Life

The life duration of the LCD panel is considered to be over 50,000 hours.
The life duration of the Back Light is considered to be over 10,000 hours based on the criteria bellow.

- (1)Operating condition
- ①Ambient temperature : 2 5 ± 5 °C
 - ②Tube current(I_f) : 6 m A or less
- (2)Definition of life
- ① When brightness is bellow 50% of the minimum brightness value shown in section 9, table 9-1.
 - ② When the CCFL turn on voltage stated in section 8 of table 8-1 exceeds 1700Vrms
 - ③ When flickering and blinking occurs based under the condition of life guarantee.

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1 2. Environmental Specification

Table 12-1 shows the environmental specification.

Table 12-1 Environmental Specification

Item	Specification		Remark
Temperature	Operation	0 ~ 5 0 °C	The temperature of the LCD panel surface (display area) temperature.
	Storage	− 2 0 ~ 6 0 °C	
Humidity	Operation	2 0 ~ 8 5 % R H	Maximum wet bulb temperature Should not exceed 29℃. No condensation
	Storage	5 ~ 8 5 % R H	
Vibration	Operation	10-500Hz, 2G peak, 2 Hrs each in X,Y,Z direction Approx. 20 min for 1 cycle.	For single module. Test criteria is stated in (Note 1)
Shock	Non-operating	15G, 6ms, 1 time each for X,Y,Z direction	For single module. When packaging refer to (Note 2)

Note 1) The distance between the vibration table and the back surface of the LCD module should be set to 3mm when conducting a vibration test.

Note 2) The shock resisting standard when packing is shown in table 12-2 and figure 12-1.

Table 12-2 Shock resistance standard when packaging module

Contact point	Dropping height	No. of times
A, B, C, D	5 5 c m	1 time each
E, F, G, H, I, J	6 0 c m	

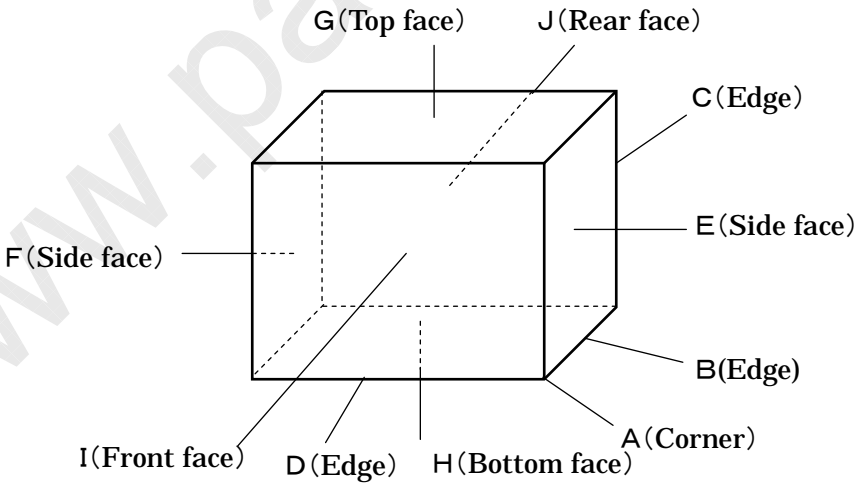


Figure 12-1 The direction of applying shock when packing

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1 6 . PRECAUTIONS

In order to use the LCD module properly, please abide by the following precautions.

(1)Handling of LCD panel

① Do not apply excessive mechanical shock to the LCD panel

The panel is made of glass. Excessive shock may cause damage or malfunction to the LCD panel.

② Do not press the panel surface too hard (MAX 20N/cm²)

There are 2 glass plates within the panel and they should be kept perfectly even to maintain display properties and reliability. If the panel is pressed hard, then the following problems may occur;

- ① Color uniformity
- ②Disorder of orientation of liquid crystal

Problem ① will clear as time passes. For problem ②, turn the power off and then on in order to bring the screen back to normal. However, these operations should be avoided to insure reliability.

③Do not scratch the polarizer film on the LCD panel surface

- Do not press or rub the display surface with a hard tool, tweezers, etc.
- When handling the panel, use cotton or conductive gloves so that the display surface is not soiled.
- If dust or dirt soils the display surface, use a soft cloth (deer skin) to clear the panel using the following method;

〔Dust〕 Dust the panel using a soft cloth. (Do not rub).

〔Dirt〕 Saturate clear water to a soft cloth and squeeze hard until there are no water drops, then wipe the surface lightly. Make sure water or solvents are not splashed onto the edge of the panel to prevent fluid from seeping into the panel. Do not use alcohol, detergent, ketone (acetone, etc.) and aromatics (xylene, toluene, etc.) as solvents.
- Adherence of saliva and water drops for a long period may cause partial deformation and decolorization. Clean the surface promptly using the 〔Dirt〕 method.
- Cleaners that are alkaline will damage the surface of the polarizer and should not be used
- Adherence of excessive oil is hard to clean and precaution should be taken to avoid oil adherence.

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④ Do not place or contact objects onto the LCD panel for a long period of time

There is a possibility that the components may deform and can cause the quality of the LCD panel to deteriorate.

(2)Handling of the LCD module

① Do not pull the cold-cathode tube cable with strength

If the cable is pulled in strength with more than 20N, then this can cause damage or deterioration of reliability.

② Assemble the equipment in a dust free environment

Especially conductive foreign matters can cause the module to fail.

③ Take anti-electrostatic measures when assembling the module

The LCD unit contains a CMOS-IC. The following points should be taken into consideration.

- General anti-electrostatic measures should be taken when handling instruments. (cotton or conductive gloves should be worn/grounding worker/disposal of ground on floor, operating table etc./disposal of operating tools (soldering iron, radio pliers, tweezers, etc.)etc.)
- Do not take the module out of the conductive bag until the module is assembled.
- Conduct the assembly of the module under a humid controlled environment (50%-60%RH).
Do not handle the module under the humid of 50%RH.

④ Do not disassemble or remodel the LCD module.

Disassembly, remodel can cause the model to fail and can cause deterioration of display quality and reliability.

(3)Precautions to be made when operating the LCD module

① Please abide by the specified power supply sequence

This is necessary to prevent latch up of CMOS-IC, failure or deterioration of the display quality and reliability due to the application of DC voltage to the liquid crystal.

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② Do not input power supply signal when condensation occurs

If voltage is applied to the panel when there is condensation on the terminal, the terminal can cause an electrochemical reaction and there is a possibility of disconnection.
Condensation occurs right after the unit has been moved from a cold environment to a warm environment in a short period of time.

③ Troubles that occur when LCD panel is not used under recommended temperature

- Operation under high temperature (Ta>50℃) : The display color shifts to blue.
- Storage under high temperature (Ta>60℃) : The contrast ratio decreases due to deterioration of polarizer film.
- Operation under low temperature (Ta< 0℃) : The response speed of the display decreases.
- Storage under low temperature(Ta<-20℃):The liquid crystal may solidify and be damaged.

④ Control signal is to be input within a specified time after the power supply has been turned on

After turning the power supply on, if control signals (DCLK, ENAB) are not input into the timing control circuit or if the input timing is not within the specified timing, this can cause deterioration of image quality such as DC drive of liquid crystal, image sticking, decrease in contrast ratio etc.

4) Precautions in regards to mounting and designing the module

① Do not put excessive pressure onto the screen and rear side of the LCD module

Excessive pressure put on to the surface of the screen under mounting condition can cause deterioration of display quality and reliability. If excessive pressure has been put onto the back light module, brightness uniformity can occur and the reliability of the CCFL may decrease.

② Avoid twisting and bending the LCD module

Twisting and bending of the LCD module can cause damage to the display quality and reliability.

③ Do not extend the power supply cable that connects the back light and the inverter

Extension of the cable can cause the backlight to not light or flicker.

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1

A

B

- B

All packages are made of recyclable papers except for the anti-ESD bag.

C

- C

Fujitsu has adopted a non-wash technology for the module assembly process.

D

D

E

F

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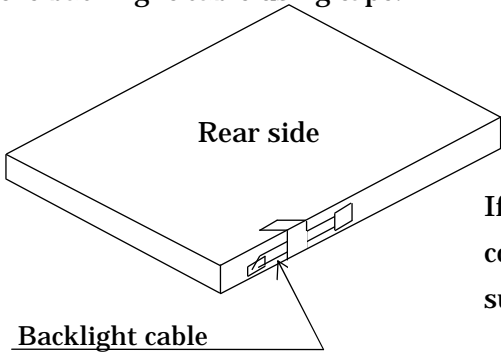
18. Return method for LCD module when requested for repair or analysis of the problem

When returning the LCD module, follow the procedure accordingly by not damaging the LCD panel or the backlight cables. (Refer to Figure 18-1,2,3,4)

It should be noted that FDTC would not take responsibility for damaged LCD modules that are returned where the reason for damage is due to failure of following the specified packaging procedure.

18-1 In case of made in Taiwan

(1) Stabilize the back light cable using tape.



If the cables are not stabilized, the connectors may scratch the LCD panel surface or it can cause damage to the cables.

(2) Put the LCD module into the anti-electrostatic bag.
(Do not use anti-electrostatic bag that are torn)

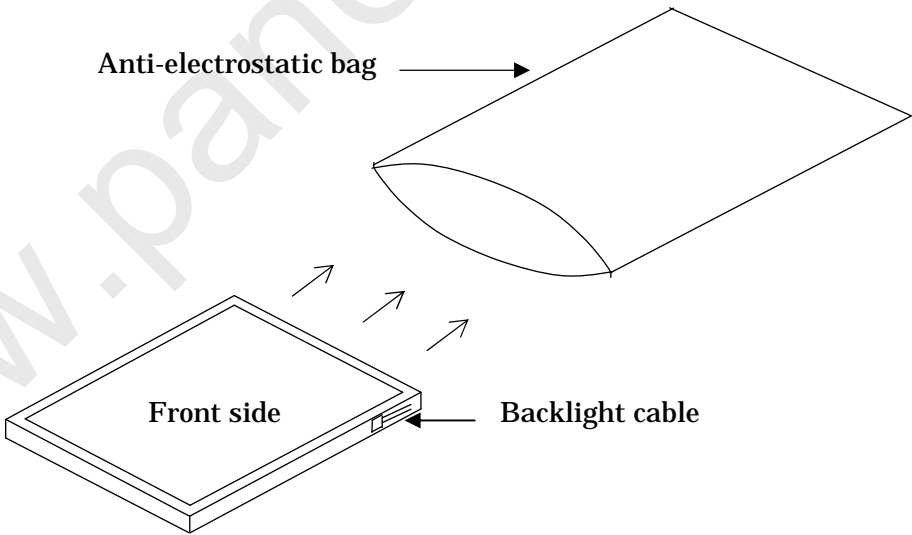


Figure 18-1 Packaging Method

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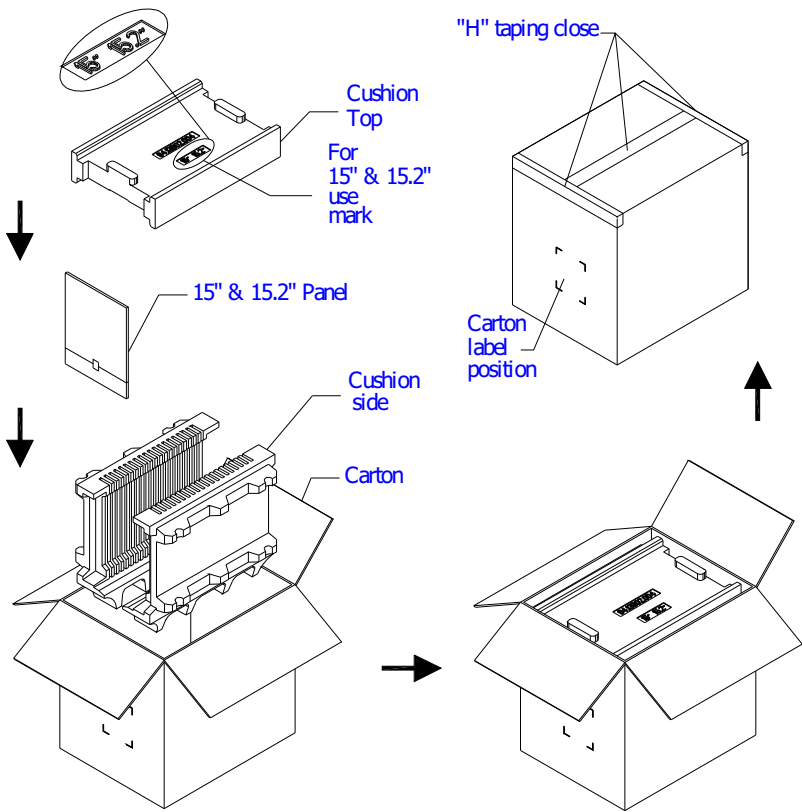
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- (3) Storing into a container box
- When using a carton box manufactured by FDTC

(Carton boxes and arrowheads that are not crushed should be used)



Place the front side of the LCD module in the direction of the arrow shown on the holder (top).

****Directions of arrowheads are shown on holders****

Figure 18-2 Packaging Method

- When using other methods of packaging other than specified above

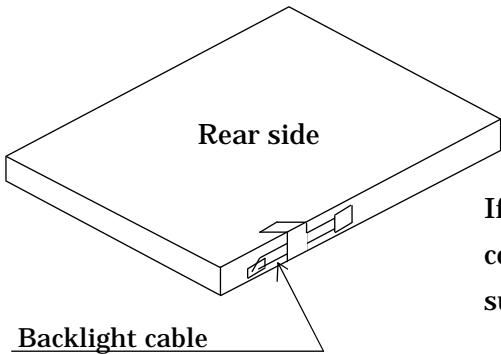
Thoughtful consideration should be taken so that damage is not made to the LCD module by wrapping the module individually with an air cap. It should be noted that FDTC would not take responsibility for damages caused by failure of packaging

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18-2 In case of made in Japan

(1) Stabilize the back light cable using tape.



If the cables are not stabilized, the connectors may scratch the LCD panel surface or it can cause damage to the cables.

(2) Put the LCD module into the anti-electrostatic bag.
(Do not use anti-electrostatic bag that are torn)

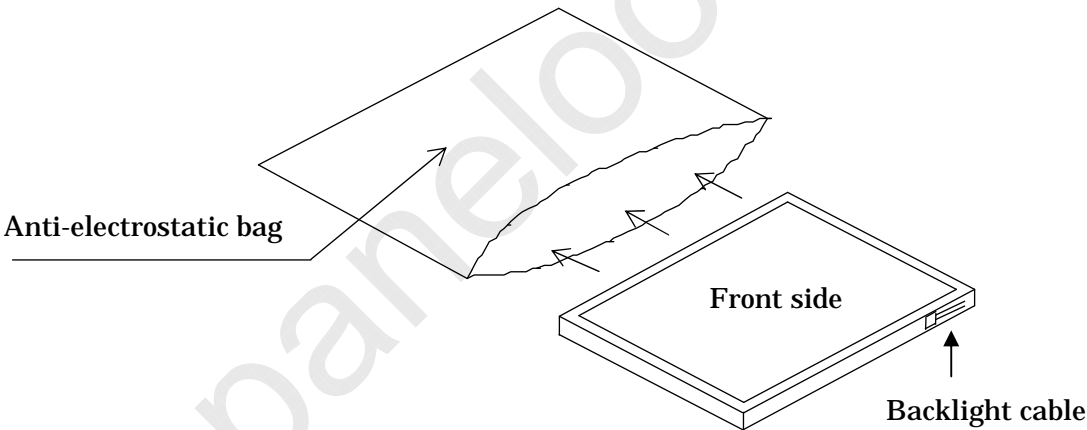
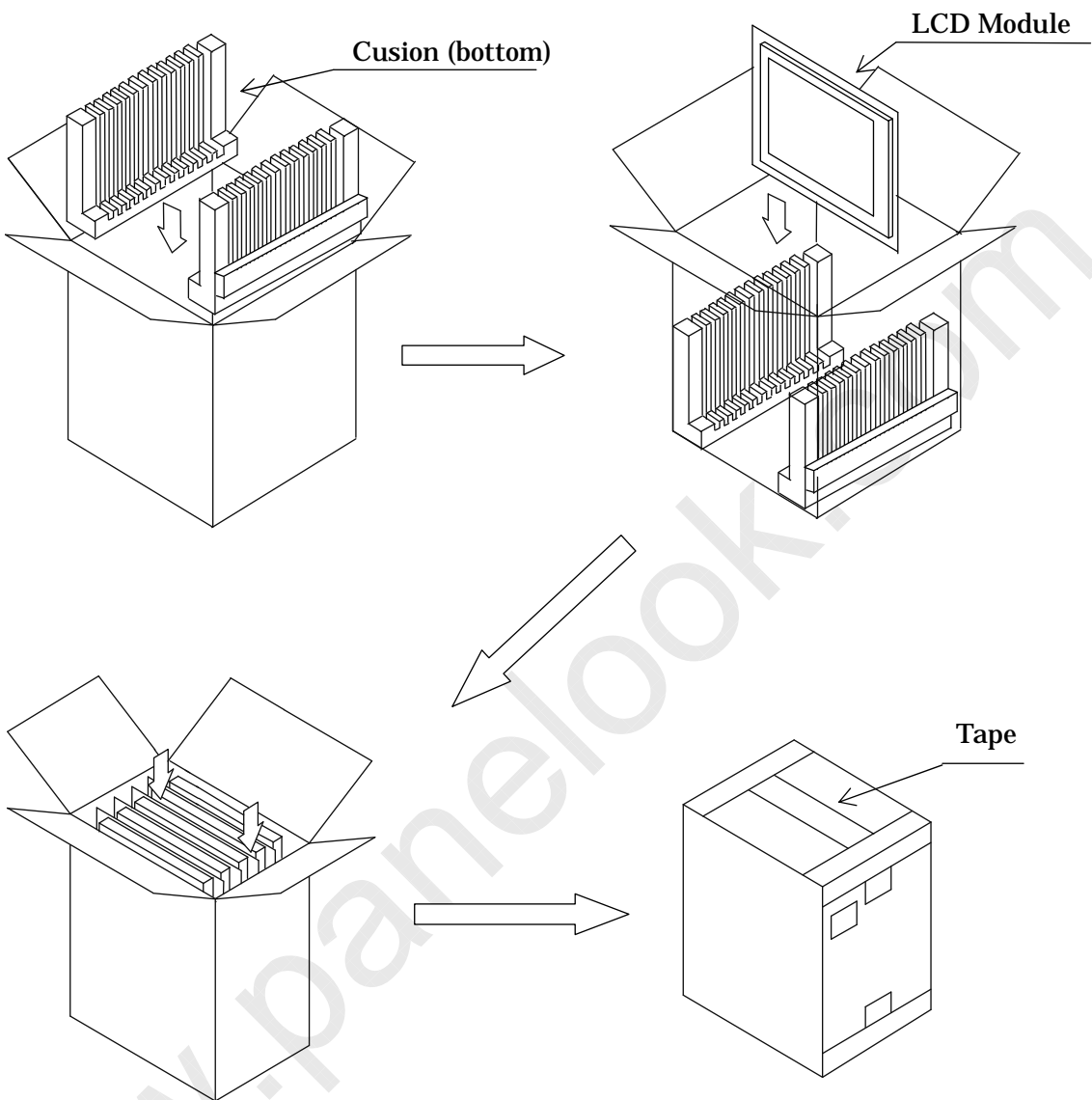


Figure 18-3 Packaging Method

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(3) Storing into a container box

- When using a carton box manufactured by FDTC
(Carton boxes and arrowheads that are not crushed should be used)



Place the front side of the LCD module in the direction of the arrow shown on the holder (top).

****Directions of arrowheads are shown on holders****

Figure 18-4 Packaging Method

- When using other methods of packaging other than specified above
Thoughtful consideration should be taken so that damage is not made to the LCD module by wrapping the module individually with an air cap. It should be noted that FDTC would not take responsibility for damages caused by failure of packaging

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